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August 17, 1992

Our ref: 903-1188

WINCO INEL
CDP bldg 654
Scoville, ID 83415

ATTENTION: Mr. John Williams

RE: ICPP GEOPHYSICAL SURVEY

Dear Mr. Williams:

This letter report presents the results of a geophysical survey conducted at ICPP within the Idaho National Engineering Laboratory (INEL) by Golder Associates Inc., of Redmond, Washington. The purpose of the survey was to locate and map underground utilities at five sites within ICPP in order to assist in selecting locations for proposed boreholes. Survey operations were conducted between August 2 and August 7, 1992.

The five sites surveyed were CPP-27, CPP-28, CPP-35, CPP-36 and CPP-58E. WINCO selected these sites based on their proposed drilling and sampling program, which is being undertaken to better define the nature and extent of possible radiological contamination. CPP-28 was surveyed in an attempt to locate eleven buried pipes that were oriented vertically.

The geophysical survey was conducted with ground penetrating radar (GPR), electromagnetics (EM) and magnetometry.

FIELD PROCEDURES

Grids were marked on the ground within areas selected by WINCO using a 300-foot cloth measuring tape and spray paint. Control points were selected for each grid and referenced to known features on the site, such as building corners. Two orthogonal baselines were run from each control point to create a grid which had 5-foot intersections. The location of surficial features, as well as the location for the proposed boring locations that were staked on the ground prior to the geophysical survey, are plotted on the field drawings (Figures 1 - 5).

At site CPP-28, the general survey area was initially identified by reviewing photographs provided by WINCO, which showed the location of the pipes before they were buried, as well as other surficial features. Once the area suspected of containing the pipes was identified, the area was surveyed with the GPR, EM and magnetometer.

Ground Penetrating Radar (GPR)

GPR lines were run at a 5-foot line spacings in both grid directions. Occasionally, a 2.5-foot line spacing was chosen in part of a grid to better map subsurface features.

The GPR survey was conducted with a GSSI System 8, consisting of a 500 MHz and 120 MHz antenna, a control unit and a 200-foot cable that connected the antennas to the control unit. The higher frequency 500 MHz antenna was used to produce a high resolution image of the subsurface with shallow penetration, while the 120 MHz antenna was used to provide a moderate resolution image with greater subsurface penetration. The maximum depth of subsurface penetration achieved with this system is estimated to be 10 feet based on analysis of the data, and information regarding depths to known utilities.

As the antenna was pulled over the ground along a survey line, an analog record, showing subsurface features, was displayed on a GSSI color video monitor, and printed on an EPC thermal recorder. Data were recorded on a Technics digital recorder to provide means for post-processing the data. When the antenna crossed each 5-foot node, an event mark was placed on the GPR record. These marks were used to correlate features identified on the GPR records with horizontal positioning on the ground.

A depth scale was established for the radargrams by opening a manhole and measuring the depth to a known utility with a measuring tape. This utility was crossed several times with the GPR to verify the calibration.

Electromagnetic (EM)

EM readings were collected at four of the five sites, and concentrated around borehole locations to check for anomalies that might indicate utilities that were not detected by GPR. EM was not attempted at CPP-27 due to the presence of surficial metal objects which produced high level background noise.

A Geonics EM-31 conductivity meter was used to collect EM data. It is a portable one-person instrument which measures subsurface electrical conductivity to an approximate depth of 18 feet. Buried metallic objects (i.e., utilities, metal drums, or storage tanks) have very high apparent conductivities, which are readily detectable by this instrument.

EM data were collected at site CPP-36 along four survey lines. Three of the lines were oriented north-south at line spacings of 10 to 30-feet, and the fourth line was oriented east-west through the center of the grid. Readings were obtained along the lines at five-foot intervals.

EM data were collected at site CPP-35 along four survey lines oriented north-south. The lines were spaced 10-feet apart and readings were obtained at five-foot intervals.

EM data were collected at site CPP-58E along two survey lines oriented north-south and located east of the construction fence. The lines were spaced approximately four feet apart and readings were obtained at five-foot intervals.

EM data were collected at site CPP-28 along three survey lines oriented north-south at a line spacing of 7.5 feet, and one survey line oriented east-west that transected the grid. Readings were obtained at two-foot intervals.

Magnetometry

An EG&G Geometrics Model G-856 proton precession magnetometer with the gradiometer option was used to collect magnetic data. It is a portable instrument that measures the earth's natural magnetic field and detects variations in this field, or anomalies, caused by changing subsurface conditions, such as buried pipelines, steel drums and storage tanks. The magnitude of the anomaly produced by an object is dependent upon its size, orientation, depth of burial, and magnetic properties. The gradiometer attachment allowed for the measurement of the vertical gradient of the magnetic field, which is not affected by diurnal variations and which is more sensitive to shallow buried objects.

Magnetometer readings were attempted at site CPP-28. However, interference from surficial metallic objects masked subsurface information. The magnetometer was not attempted at any other site due to surface tanks, drums and buildings and known subsurface utilities.

RESULTS

The results from the GPR and EM survey are shown on the five site maps provided with this report (Figures 1 - 5). Each map depicts the location of the survey lines, subsurface utilities that were detected on the GPR data and their corresponding depths, and EM anomalies. Not all of the utilities shown on the maps provided by WINCO were detected during the geophysical survey. The depth to targets on the GPR records are referenced to ground surface, based on a velocity through soil of 6.3 nanoseconds per foot. The following results refer to proposed borehole locations that appear to be located in close proximity to utilities.

Site 27: Boring 27-2 appears to be located over a subsurface concrete footing, which is at a depth of 4 feet. A utility appears to be oriented north-south approximately 1.5 feet east of Boring 27-3 at a depth of 2.5 feet.

Site 28: GPR data showed a "ringing" in the records in seven locations, which may denote the location of vertically oriented pipes. Two of the seven locations are approximately 1 feet north of a utility running east-west at a depth of 7 feet. Magnetometer measurements were also attempted in this region, however, the magnetic characteristic of surficial features masked subsurface information.

Site 35: Boring AD-2 appears to be located over a buried asphalt surface. EM data showed an anomaly in the vicinity of AD-3, although the GPR records showed the closest utility to be located 4.5 feet southwest of AD-3 at a depth of 3.5 feet.

Site 36: A utility appears to be running east-west approximately 1.5 feet north of boreholes DW-1 and AD-2 at a depth of 3 feet. AD-2 also appears to be located along the edge of the stack's concrete footing, which is at a depth of 3 feet. Another utility appears to be oriented

east-west approximately one foot south of borehole AD-4 at a depth of 2.5 feet.

Site 58E: A utility appears to be running east-west approximately one-foot north of 58E-1 at a depth of 0.5 foot. Boring 58E-2 appears to be located between a utility located 1.5 feet to the north at a depth of 4.5 feet, and a utility 2.5 feet to the south at a depth of 7 feet.

While GPR, EM and Magnetometry can be used to locate utilities, it is subject to the limitation of the principles of physics and Golder Associates Inc. does not guarantee that all utilities were located in the areas surveyed.

Sincerely,

GOLDER ASSOCIATES INC.

Rory Retzlaff
Staff Geophysicist

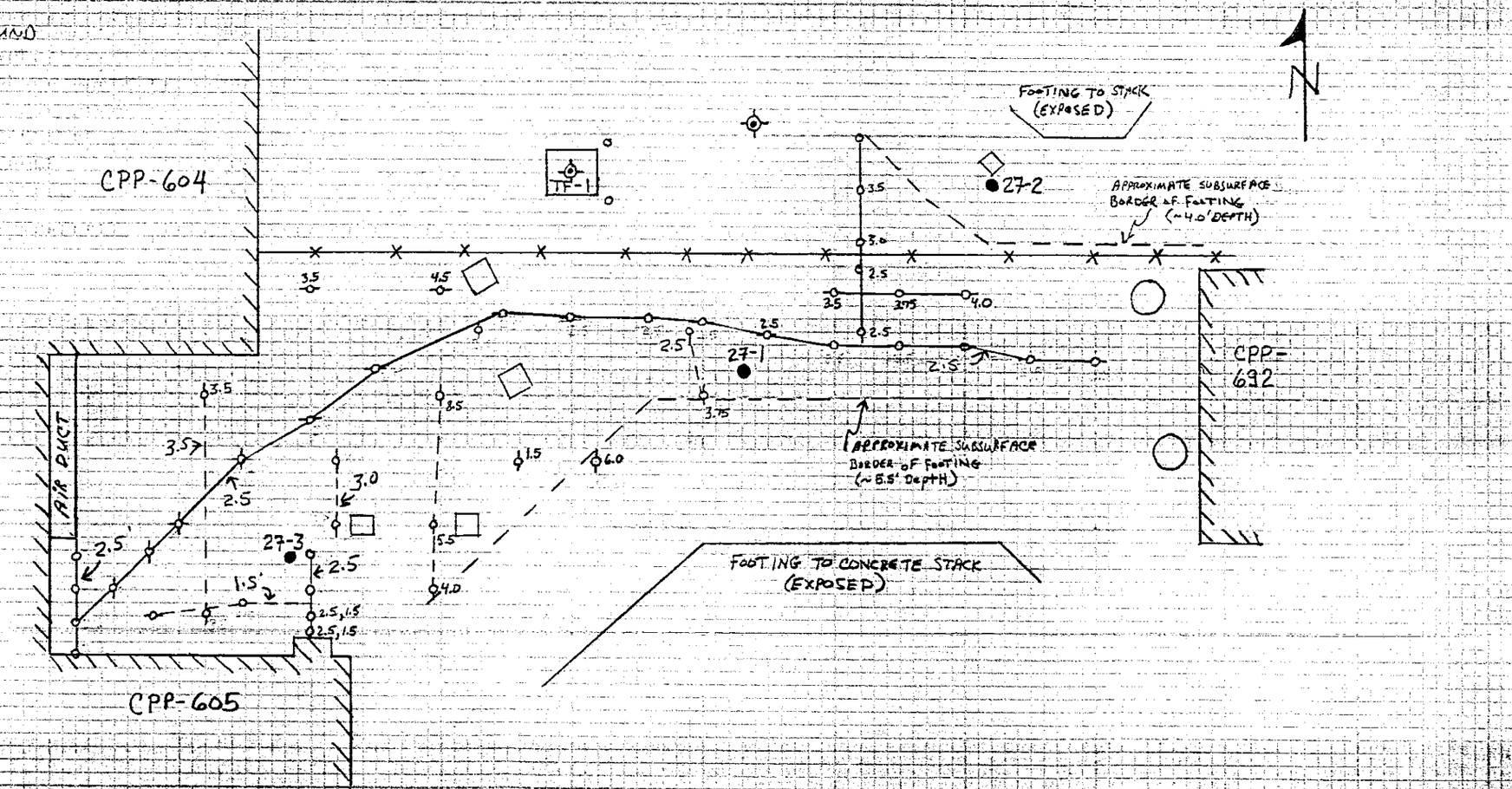
Dick Sylwester
Senior Geophysicist

RR/DS/db

SITE CPP-27

EXPLANATION

- 2.5 — TARGET LOCATION, ORIENTATION AND DEPTH
- UTILITY ORIENTATION
- PROBABLE UTILITY ORIENTATION
- 27-1 ● BOREHOLE
- MONITORING WELL
- SQUARE CONCRETE PILING
- CIRCULAR CONCRETE PILING
- FENCE



SCALE 1"=10'

0 5 10 20

FIGURE 1

SITE CPP-28

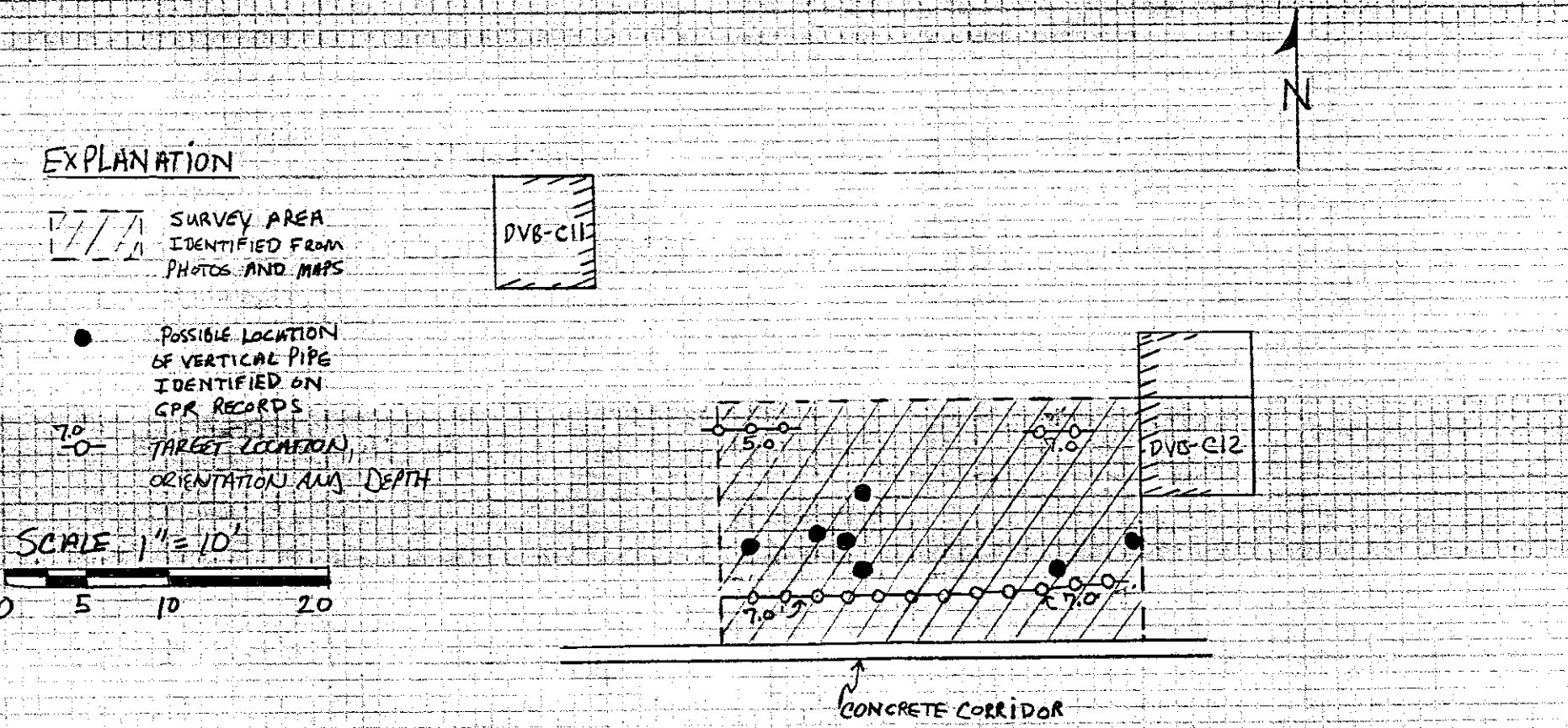


FIGURE 2

SITE CPP-35

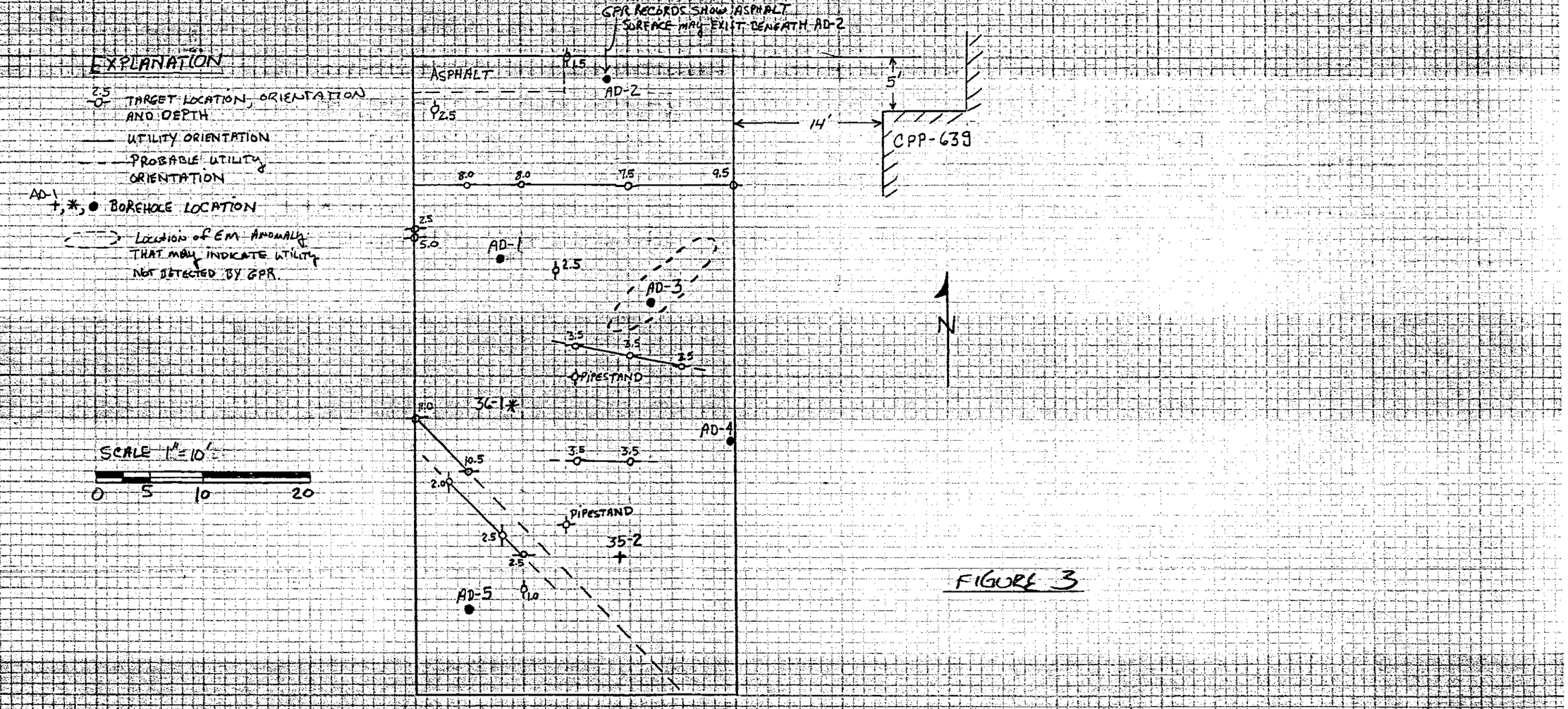


FIGURE 3

SITE CPP-36

CPP-708

SCALE 1" = 10'
0 5 10 20

EXPLANATION:

- 2' — TARGET LOCATION, ORIENTATION AND DEPTH
- ---- PROBABLE UTILITY ALIGNMENT
- AD-1 ● BOREHOLE
- ⊕ OBSERVATION WELL

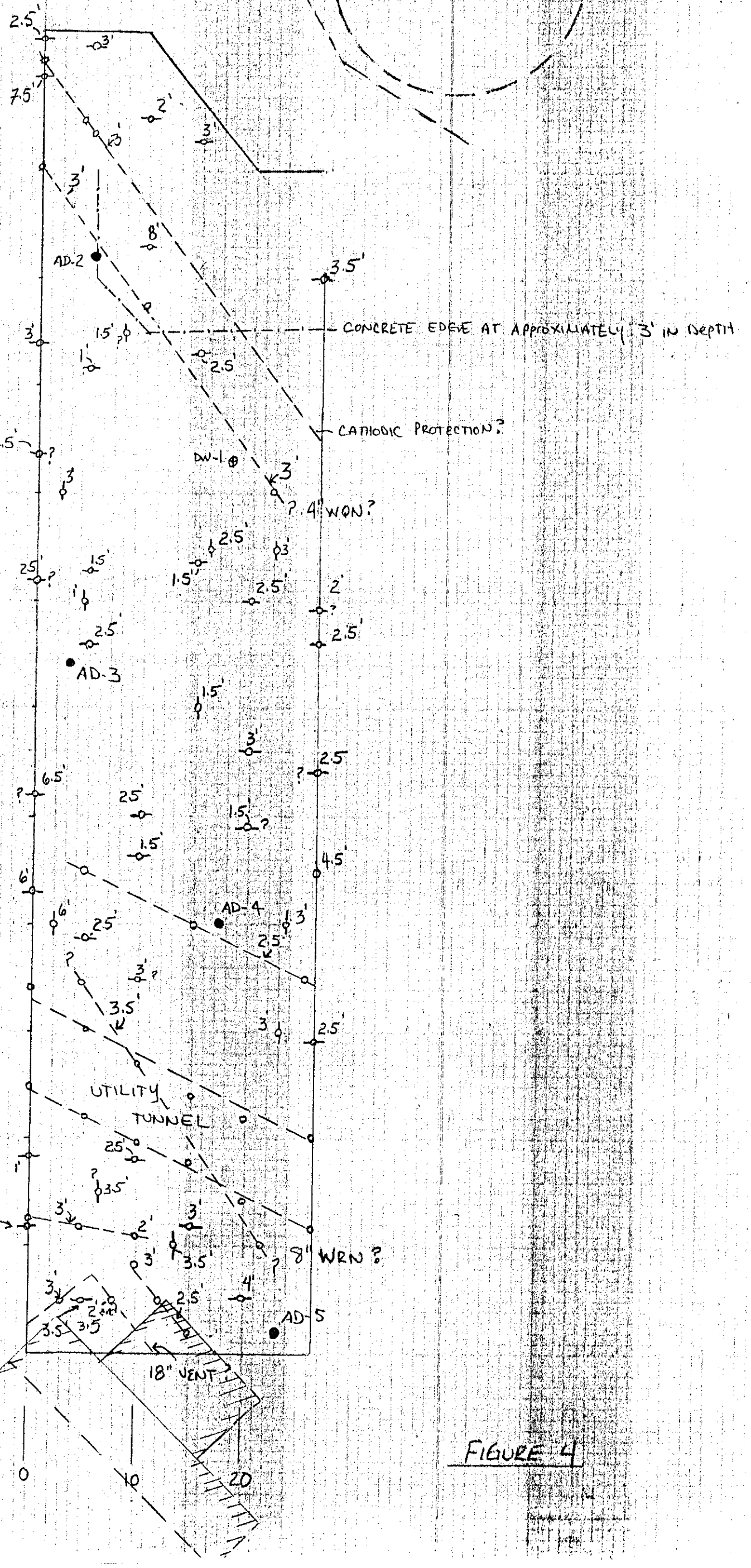


FIGURE 4

SITE CPP-58E

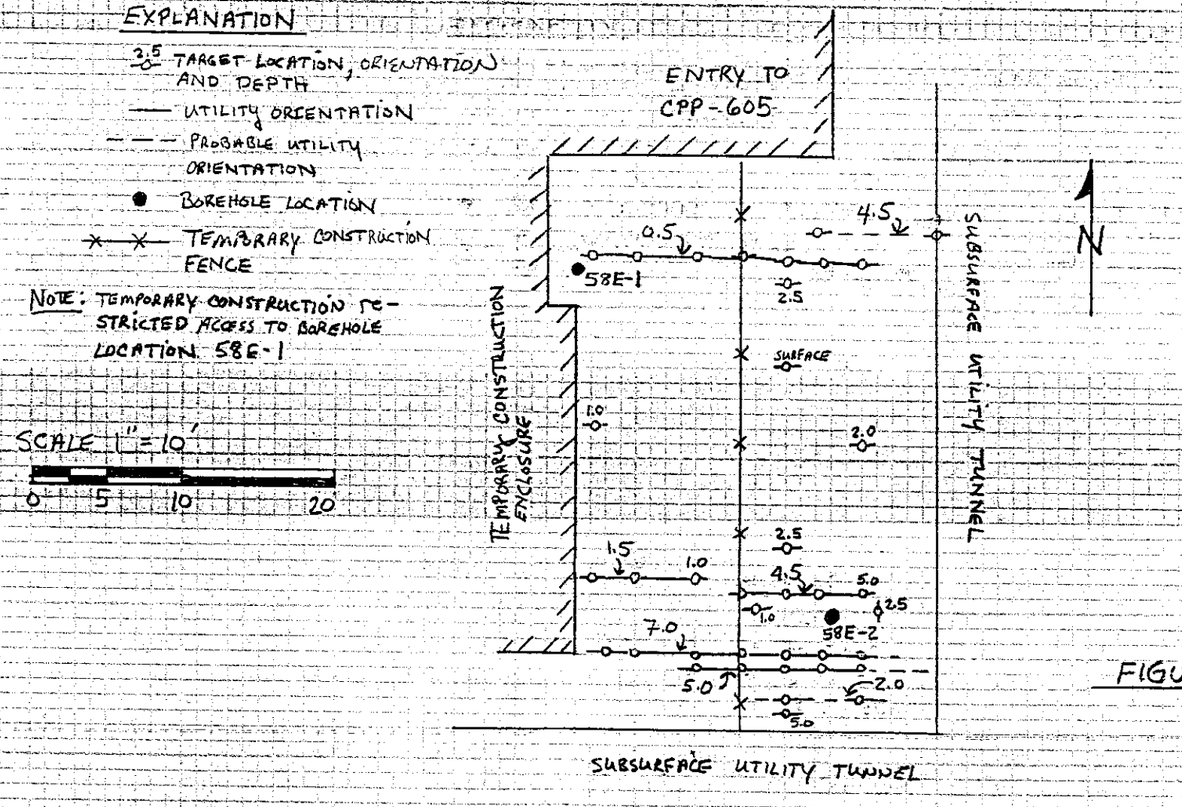


FIGURE 5